Statistiek & Ethiek

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VvS+OR

Statistiek & Ethiek

- Inleiding: Het geval Lucia de B. als *casus*

- Ethiek:

  - Kant: Categorical Imperative

  - Rawles: Randomized variant

  - Gill: ?

- Lucia en de Statistiek

- Conclusies

Inleiding

Ik was een recente "Lucia" voordracht aan het bijwerken met nieuwe kop en staart, met bespiegelingen over professionele en academische ethiek, ihb wat betreft de statistiek, en daar dicht in de buurt jullie vakgebied.

Er zitten aspecten in van wetenschappelijk versus bedrijfscultuur, van procesdenken versus creatief denken, van nederlands cultuur versus angelsaksisch.

De bizarre "zaak Lucia de B." is tegelijkertijd uniek en (zoals een Griekse tragedie) universeel. Maar naast toeval en lot speelde actuele ontwikkelingen in onze maatschappij een belangrijke rol. We *kunnen* en *moeten* lering uit trekken. In deze zaak was de zwakte van de statistici fataal, tegenover de slechte eigenschappen van de gevestigde sterke gemeenschappen van de medici en de juristen.

Conclusie: we hebben sterke zelfverzekerde en onafhankelijke, maar ook open en transpante professionele verenigingen nodig. Mijn proviso, omdat we niet alleen een machtsblok om de eigen belangen te behartigen moeten worden. Macht corrumpeerd, nietwaar?

De vorige versie werd gegeven aan de grote hackersconferentie in Vierhouten.

Ethiek
(de preek van vandaag, begin)

- Kant
- Rawles
- Gill

Kant

Kant, Immanuel (1724−1804), German philosopher. In the Critique of Pure Reason (1781) he countered Hume's skeptical empiricism by arguing that any affirmation or denial regarding the ultimate nature of reality ("noumenon") makes no sense. His Critique of Practical Reason (1788) affirms the existence of an absolute moral law—the **categorical imperative.**

European

Rawls

n=2, randomized

Rawls, John (1921−2002), U.S. philosopher. His books *A Theory of Justice* (1971) and Political Liberalism (1993) consider the basic institutions of a just society as those chosen by rational people under conditions that **ensure impartiality.**

Anglo-Saxon

Gill

n>2, randomized? Weighted? Who counts?

Gill: Gill, (Arthur) Eric (Rowton) (1882–1940), English sculptor, engraver, and typographer. Did the relief carvings Stations of the Cross (1914–18) at Westminster Cathedral and the Prospero and Ariel (1931) on Broadcasting House in London. Designed the first sans serif typeface, Gill Sans.

gill [1] noun (often **gills**): **1** the paired respiratory organ of fishes and some amphibians, by which oxygen is extracted from water flowing over surfaces within or attached to the walls of the pharynx [• an organ of similar function in an invertebrate animal]; **2** the vertical plates arranged radially on the underside of mushrooms and many toadstools; **3** the wattles or dewlap of a fowl [• (**gills**) the flesh below a person's jaws and ears: we stuffed ourselves *to the gills* with scrambled eggs and toast].

verb [trans.]: **1** gut or clean (a fish); **2** catch (a fish) in a gill net.
PHRASES **green around** (or **at**) **the gills** (of a person) sickly-looking.
DERIVATIVES **gilled** adjective : [in combination] *a six-gilled shark.*
ORIGIN Middle English : from Old Norse.

gill [2] noun: a unit of liquid measure, equal to a quarter of a pint.

ORIGIN Middle English : from Old French *gille 'measure or container for wine,'* from late Latin *gillo 'water pot.'*

gill [3] noun Brit.: a deep ravine, esp. a wooded one [• a narrow mountain stream].

ORIGIN Middle English : from Old Norse *gil 'deep glen.'*

gill [4] (also **jill**) noun: **1** archaic a young woman; a sweetheart. **2** a female ferret. Compare with **hob** [2] (sense 1).

ORIGIN late Middle English : abbreviation of the given name *Gillian.*

Lucia: mijn motieven

- 2001: Heksenjacht

- 2003: Heksenproces

- 2004: Zonder statistiek

- 2006: Boek van Ton Derksen, Metta de Noo

- Gesprek met journalist, lezing van *arrest*

Lucia: mijn motieven

- Schaamte

- Woede

- Passie voor mijn vak
  (statistiek, wiskunde, wetenschap)

Lucia en de Statistiek

Lies, damned lies, *& legal truths*

Dramatis Personae

Dramatis Personae

17 judges: Fokkens, Fokkema, Fokking...

JKZ director Smits

The Derksen family

An army of medical experts

...

Dra...hae

17 judges: Fokker...
JKZ director Smit...
The Derksen fami...
An army of medic...

...

2001: JKZ, the Hague

- 4 Sept, early morning: baby Amber unexpectedly dies; <u>natural death</u> registered

- Later that day: a nurse goes to *chef de clinique* with "bad feeling": *Lucia was on duty again …*

- C-C does Excel spreadsheet statistics: <u>no coincidence</u>

- … goes to director Smits

- 5 Sept: Amber's death is now <u>unnatural</u>

- 5–17 Sept: 30+ incidents & deaths at JKZ and RKZ attributed to Lucia; gossip; …

- 17 Sept: press conference; newspaper report; 5 deaths and 5 suspicious incidents reported to police

2003: the Hague
Lower court

- Lucia pleads innocent

- and gets life sentence for 4 murders + 2 attempts at JKZ, RKZ, Leienburg

- Statistics essential: "1 in 342 million"

- No medical proof. Only statement of co-detainee

- Both defence and prosecution appeal

Elffers: "Your honour, it was <u>not</u> chance. The rest is up to you."

2004: the Hague
Upper court

- Lucia gets life sentence +<u>TBR</u> for 7 murders + 3 attempts

- Medical proof that Amber died of digoxine; it was administered by Lucia (opportunity); motive: compulsion

- No statistics

- Chain argument

- Defence appeals (*novum* – mislaid Strasbourg lab finding "no digoxine")

<u>TBR</u>= *ter beschikking rechter* = permanent detention in psychiatric care

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<u>TBR</u>= *ter beschikking rechter* = permanent detention in psychiatric care

2006: the Hague
Supreme court

- Conviction is upheld except that <u>TBR</u> is ruled illegal (*)

- Upper court (a new one) complies

- Lucia suffers a stroke

(*) No relevant psychiatric disorder + non-guilty plee

Meanwhile ...

- <u>Medical doctor</u> Metta de Noo (*née* Derksen), sister-in-law of JKZ chief paediatrician Arda Derksen (*née* Lubsen) becomes uneasy

- The Derksen family is split; "committee Lucia de B." researches case

- <u>Philosopher</u> Ton Derksen publishes *Lucia de B: reconstruction of a miscarriage of justice* growing media interest

- <u>Computer scientist/statistician</u> Peter Grunwald reads it and makes me read it too

growing media interest

- 2006: Derksen submits to CEAS: Committee for Evaluation of Closed Cases

Lucia de B.

Reconstructie van een gerechtelijke dwaling

Ton Derksen

2007
Report of the CEAS

- Prosecution of case was tainted by tunnel-vision from very beginning

- "Experts" were chosen from small circle around JKZ, later advised police, later advised courts

- Experts disagree on cause of death of Amber

- Case should be reopened

The public debate

- Slowly, the media change sides

NATURE !

- Petition for reopening the case to minister; candle-light demonstration at prison; newspaper full page advert; ...

Nobel laureate!

- The legal establishment digs in its heels

Undermining the foundations of the state!

- Politicians are silent

- The medical establishment is silent

- Intellectuals, artists, scientists become involved

- Public opinion and academic opinion are won for Lucia

- Key figures in legal establishment are won for Lucia

2008 The supreme court

- Advocate-General sees no *novum* in CEAS report

- <u>Despite this</u>, he commissions a multi-disciplinary medical investigation into case of Amber

- <u>Lucia's sentence is temporarily suspended</u>

- Investigation findings: Amber's death could well have been natural (exhaustion)

- A-G notes that Lucia did not lie about her doings <u>and</u> asks key trial expert if he agrees with new findings – <u>Yes</u>; he had been given incomplete information! A-G requests Supreme Court to reopen the case

- Supreme Court: <u>that</u> is indeed a *novum*

2009: the last act?

- Prosecution proposes major new *forensic-criminalistic* investigation (vs. defence's *theoretical-scientific*), on lines of "offerte" by <u>Independent Forensic Services</u>

- ... but the court continues A-G's medical investigation into cases of Amber, Achraf, Achmad only

  - Belgian toxicologist (early in the case came out strongly against Lucia) asked for contra-expertise re. Amber

  - *Still never been heard*:
    - a statistician
    - from medicine: the 2 qualified persons with overview of whole case (Arda Derksen, Metta de Noo)

Is statistics played out?

- Statistics initiated the case

- Statistics central to 2003 conviction

- 2004: "*no statistical probability calculation*"; "*all deaths and incidents shown by incontrovertible medical-scientific evidence to be unnatural*"

- ... yet from publication of Derksen's book, statisticians at the heart of public movement to reopen case: why?

The Statistics
Lucia's working places

- Juliana Kinderziekenhuis (JKZ), *mcu*

- Rode Kruis Ziekenhuis (RKZ), *icu-42*

- Leijenburg Ziekenhuis

- Penintentiaire inrichting, Scheveningen

The Statisticians

For the police, and later for the lower and higher court:

- Henk Elffers (*law psychologist*)

- Richard de Mulder (*law and ict*)

For the defence (on appeal)

- Ronald Meester (*probability theory*)

- Michiel van Lambalgen (*AI, logic*)

Elffers' data

Shifts	with incident	without incident	Total
with Lucia	9	133	142
without L.	0	887	887
Total	9	1020	1029

JKZ (2nd year only)

Shifts	with incident	without incident	Total
with Lucia	6	52	58
without L.	9	272	281
Total	15	324	339

RKZ-42

Shifts	with incident	without incident	Total
with Lucia	1	0	1
without L.	4	361	365
Total	5	361	366

RKZ-41

Elffers' 1 in 342 million

- Three Fisher exact tests

- JKZ: *post-hoc* correction by Bonferroni: 26 nurses

- Multiplication of three p-values

- Elffers emphasized that correlation $\nRightarrow$ causation

- *By way of example*, perhaps:

  - Lucia is a bad nurse (but not a murderer)

  - Lucia has more difficult shifts

  - Lucia has more night shifts

  - Someone is trying to set Lucia up

de Mulder confirms

- Elffer's methodology is correct

- Even if the data is not completely correct, conclusions won't be changed

- It is certainly not a coincidence

- Lucia must explain why she was there

Statistics out, from 2004?

- The incidents at JKZ occurred in a short period in a ward where usually nothing happened

- Lucia was present every time

- A natural cause was ruled out, medically, in every case

- Lucia couldn't explain why she was repeatedly present

Statistics out, from 2004?

- The incidents at JKZ occurred in a short period in a ward where usually nothing happened   ?

- Lucia was present every time   ?

- A natural cause was ruled out, medically, in every case   ?

- Lucia couldn't explain why she was repeatedly present   ?

The legal concept of irrefutable medical-scientific proof of
unnatural death

- If the precise time of a death from complex causes can't be predicted, the (time of) death is *inexplicable*

- An *inexplicable* death is a *suspicious* death if Lucia is present, and hence perhaps *unnatural*

- For every case separately, a majority of medical experts thought the death was natural; but always one could be found who thought it unnatural

- In two cases, only one expert thought it was unusual; why? *Only* because Lucia was there!

Elffers and de Mulder's expertise come in handy

- Chain proof: we have a lying murderess who was present at similar medically inexplicable events

- she must explain her presence (de Mulder), escape clauses (Elffers) are ruled out by herself

  Judge: "*Mrs de Berk: were you a bad nurse?*"
  Lucia: "No, your honour, my superiors and colleagues ..."

  Judge: "*Mrs de Berk: did you work more difficult shifts than your colleagues?*"
  Lucia: "No your honour, we shared all the work fairly ..."

More sharp legal thinking

A-G anticipates supreme court counter-arguments

- That Amber died of exhaustion on Sept 4 doesn't mean that she wouldn't otherwise later have died of digoxine poisoning

- That there were similar clusters of events at JKZ in earlier and later years doesn't mean that every one of the deaths in "Lucia's cluster" are natural

Old data

, , JKZ

	Incident	Normal
Lucia	9	133
Others	0	887

, , RKZ41

	Incident	Normal
Lucia	1	0
Others	4	361

, , RKZ42

	Incident	Normal
Lucia	6	52
Others	9	272

Latest data

, , JKZ

	Incident	Normal
Lucia	7	135
Others	4	883

, , RKZ41

	Incident	Normal
Lucia	1	2
Others	4	359

, , RKZ42

	Incident	Normal
Lucia	5	53
Others	10	271
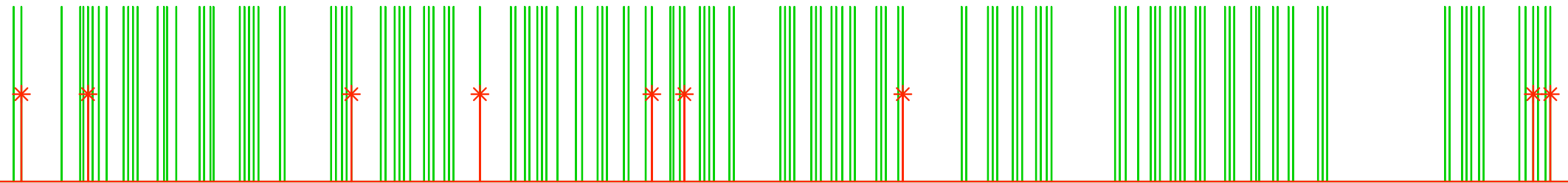
- Three children represent 7=2+2+3 of the now 11 incidents (one illegal euthanasia removed)

- Two incidents actually occurred in the shift *after* Lucia's

- At least two incidents outside of Lucia's shifts are missing (they weren't *suspicious* incidents)

The latest *p*-values

- <u>Cochran-Mantel-Haenszel test</u>
  JKZ; RKZ-41, -42; & Elffers' post-hoc correction
  1 in 916

- <u>Ultimate stratification</u>
  11 *days* at JKZ with both incident & Lucia on duty
  1 in 25

- <u>Gamma(1) heterogeneity over Poisson intensity</u>
  JKZ, RKZ pooled
  1 in 25

& what about ... ?

- *Post-hoc* problem

- Data selection problem

- Information from outside Lucia period;
  total number(s) of incidents.
  [Elffers analyses distribution of incidents *between* nurses,
  within period]

Approaches

- Significance testing

- Grand Bayesian synthesis

- Likelihood Ratio

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- ~~Significance testing~~
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- ~~Significance testing~~
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Likelihood Ratio

- What is hypothesis of defence, H_0?

- What is hypothesis of prosecution, H_A?

  - Elffer's H_0: conditional on shifts, incidents are uniformly random

  - Defence: you can't use statistics
    H_0 : the incidents would have happened anyway

  - Prosecution: the incidents happened because Lucia proved them, so they were certain
    H_A: the incidents were happened because Lucia was there

Basic empirical research for H_0 still missing

(let alone H_A)

- Events are strongly clustered

- Shifts fall in regular patterns

- Variation between nurses
  [a nurses' actions can *define* when/what is an incident]

- Differently qualified nurses do get different shifts

- A hospital ward is in a non-constant environment
  [winter/summer, changing admissions/discharge policy, opening/closing other wards]

- Multiple incidents concerning same patient

- Hidden confounders cause heterogeneity between nurses, between days

- $\mathrm{var}(X) = \mathrm{E}(\mathrm{var}(X|Y)) + \mathrm{var}(\mathrm{E}(X|Y))$

- *Independent uniform* random rare events (<u>Elffers</u>): variance ≈ mean

- Unmeasured heterogeneity: variance ≫ mean

The basic empirical research for H_0 is still missing ...

and as long as it remains so, statistics does not help the prosecution (though it might help the defence)

Likelihood Ratio problems

- parties must *agree* on "sampling frame"

- who owns the hypotheses?

- posthoc hypotheses not allowed

- nuisance parameters

- ...

- The defence isn't obliged to play the game (the *prosecution* must convince the *court* that, beyond reasonable doubt, ...)

Approaches

- ~~Significance testing~~
- ~~Grand Bayesian synthesis~~
- ~~Likelihood Ratio~~

Lucia Lessons

- Many reforms are being made

- "Science" and "Justice" are talking together

- Still: gut reaction of "system" is:
  create rules, checklists, registers

- <u>We</u> want honest cops, upright magistrates, intelligent and knowledgable lawyers, wise judges who weigh all the evidence and use their common sense and intellect and humanity

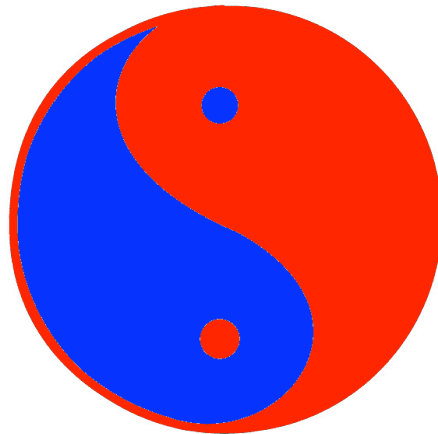- We want the system to admit mistakes so that it can learn from them

"Science" vs. "Justice":
was this a typical case of
alpha vs. *beta*?

- No!
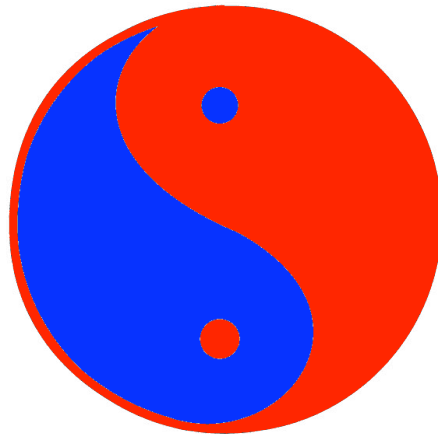
  - scientific community – creative thinking
  - legal community – bureaucratic thinking

"Science" vs. "Justice":
was this a typical case of
alpha vs. *beta*?

- No!

  - scientific community – chaos, change

  - legal community – harmony, certainty

For an establishment like a national legal system,

Learning represents the possibility of
failure
and must thus be avoided if possible

Ethiek

(de preek van vandaag, sluiting)

- Gelukkig, dankzij credit-crisis, ethiek is weer "in"

- Een goede tijd voor reflectie

- Professionaliteit, waarheid, bewustzijn dat we maar een gedeelte van een geheel zijn (verantwoordelijkheid)

- Individu versus collectief

- Voor mij telt persoonlijke ethiek boven alles maar wat de mijne is, gaat eigenlijk alleen mij om

- Voor jullie om jullie professionele ethiek te bepalen

Conclusie

Ik was een recente "Lucia" voordracht aan het bijwerken met nieuwe kop en staart, met bespiegelingen over professionele en academische ethiek, ihb wat betreft de statistiek, en daar dicht in de buurt jullie vakgebied.

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